Plug-In Michigan

Michigan Plug-in Vehicle Preparedness Taskforce

House and Senate
Energy & Technology Committees
May 10, 2011

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Overview and History

Orjiakor Isiogu, Chairman
Michigan Public Service Commission

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Michigan's Plug-in Preparedness Taskforce

- *Automotive Manufacturers*
- *Clean Cities Coalition*
- *Dept. of Licensing and Regulatory Affairs (formerly DELEG)*
- *Electrical Contractors*
- *Environmental Groups*
- *Michigan Public Service Commission*
- *Not for Profit Corporations*
- *Utilities (both regulated and public)*
- *Other Interested Parties*

3

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Michigan's Plug-in Preparedness Taskforce

- Key Milestones
  - Supported passage of building code rules regulating charging station installations - 2010
  - Hosted Ride and Drive event – 2010
  - Launched www.PlugInMichigan.org website – 2011
  - Transitioned to Taskforce member-led group - 2011

4

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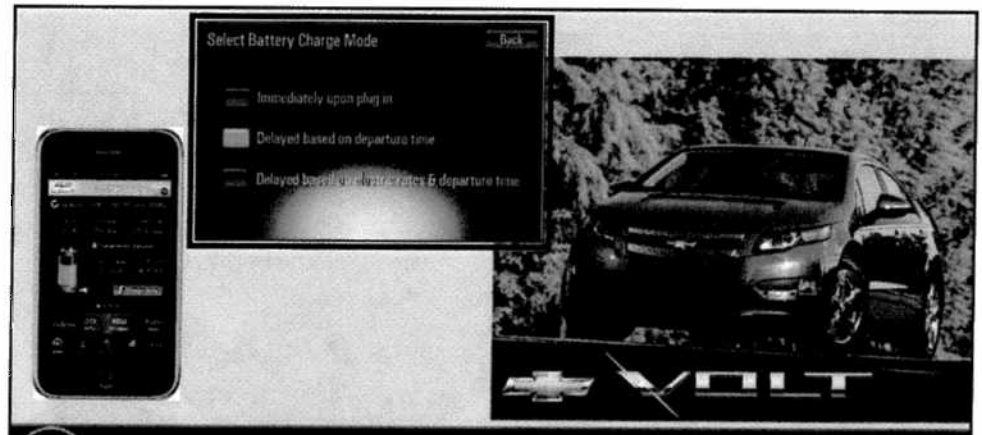
Automotive Perspective

Kristin Zimmerman, General Motors
Charlie Pryde, Ford Motor Company
Jay Iyengar, Chrysler



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Kristin Zimmerman
Advanced Technology Infrastructure – Chevy Volt Program
General Motors

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Definition of PEV & EVSE

PEV = Plug in Electric Vehicles - All PEV categories are listed below:

- BEV - Battery Electric vehicles (e.g. Nissan Leaf, Tesla Roadster)
- EREV - Extended Range Electric Vehicles (e.g. Chevy Volt) and
- PHEV - Plug-in Hybrid electric vehicles (e.g. Ford Escape Plug in Hybrid)

EVSE = Electric Vehicle Supply Equipment:

- Charging cords and stations are called EVSEs – Mfers include:
  - Lear/Voltec, Coulomb Technologies, Clipper Creek, EcoTality, Eaton, Leviton, GE, PEP.... There are over 40 manufacturers
- The Society of Automotive Engineers (SAE) J1772 developed the common/standard charge coupler for the vehicle
- The actual charger is located on-board the vehicle. Specific vehicle charging requirements vary by each auto OEM
- The Volt charges in 3-4 hours with a level 2 (240v) EVSE and 8-10 hours with a common house plug (120v).

Level 1: 120v

Level 2: 240v

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Vehicle Roll-Out Plans for Chevy Volt

- Model year 2011 production is on schedule with strong/growing demand
- Made in Michigan:
  - Detroit-Hamtramck - Vehicle
  - Brownstown - Battery System
- March - Michigan Market opened
- Chevy Volt sales and orders in Michigan continue to grow and are nearing 500 vehicles through April

- Model year 2012 production begins in September 2011
- Chevy Volt retail markets will be national by 4th quarter 2011
- Chevy Volt in Canada July 2011
- Chevy Volt - launching in late 2011 in Europe and China

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Early Volt Markets - What are we learning?

Early Adopters Influence and Drive Mainstream Adoption:

- Volt early launch markets targeted early adopter markets
- Many Volt customers are former Prius owners – 90% of current Volt customers previously from outside the brand
- Early Volt customers include:
  - the environmentally/energy security conscious;
  - the electrical contractors/inspectors who play an integral role in safely and cost effectively installing level two charging at the home; and
  - early technology adopters
- Prospective customers are motivated by current customers blogging of experiences with their Volt to date: (5 months of real data)
  - fun to drive;
  - exceeds expectations;
  - experiencing over 1,000 miles per 9 gallon tank of fuel;
  - great ride and handling on snowy roads; and
  - safe (IIHS highest safety pick)

9

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Challenges/Opportunities

Barriers being removed by the MPSC PEV Taskforce

Over 5,000 "free" residential EVSEs for PEV customers in MI

Ongoing Challenges: Continue to ...

- Target cost reductions for the customer by removing purchase, ownership and operation barriers:
  - Install residential charging with favorable utility, smart PEV charging options
  - Streamline permitting, inspection and electrical contractor training
- Educate the broader public and policy making entities on the activities of the state/nation regarding PEV/Smart Grid Planning (MI Smart Grid Collaborative)
- Develop on-line tools empowering purchase choice for the customer

Opportunities:

- GM's early notification process – Volt customers opt in to inform utilities where they live – assists future local grid planning
- Vehicle to Grid (V2G) Communications Demonstrations – OnStar
- Secondary Battery Use – Community Energy Storage, power quality/reliability & frequency regulation for the grid, back up storage, etc.

10

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Charlie Pryde
Regional Governmental Affairs Director
Ford Motor Company

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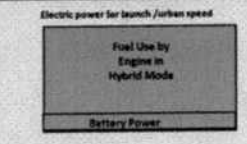
Electrified Vehicle Alternatives: Customer Driven

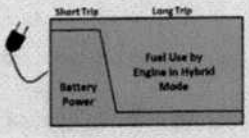
HEV

Urban and Highway (highest volume and best FE/$)



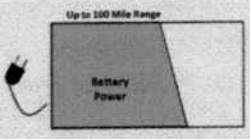
PHEV

Primarily Urban and Some Highway (promotes energy diversity)



BEV

Urban (zero emissions but with range limitations)



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Ford Sustainability Strategy

TECHNOLOGY MIGRATION

2007	2012	2020	2030
NEAR TERM	**MID TERM**	**LONG TERM**	
BEGIN MIGRATION TO ADVANCED TECHNOLOGY	FULL IMPLEMENTATION OF KNOWN TECHNOLOGY	CONTINUE LEVERAGE OF ELECTRIFIED VEHICLES AND DEPLOYMENT OF ALTERNATIVE ENERGY SOURCES	
EPAS 6-SPEED TRANSMISSIONS ECOBOOST WORLD-CLASS HYBRIDS BEGIN BEV INTRODUCTION	AUTO STOP-START SUBSTANTIAL WEIGHT REDUCTION WORLD CLASS BEVs WORLD CLASS PHEVs		

Ford's Sustainability Strategy, Founded On Affordability For Millions Of Customers, Remains In Place As We Move To The Mid-Term

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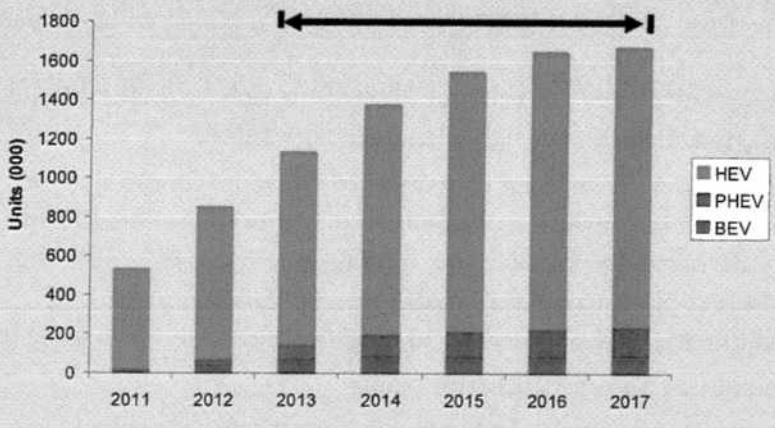
2011-2017 U.S. EV Volumes by Technology Type



Source: JDPA U.S. Hybrid-Electric Vehicle Forecast - Second Quarter 2010

14

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New Electrified Vehicles

THE POWER OF CHOICE

Ford's Strategy Is To Electrify Global Platforms With All 3 Electric Solutions – To Drive Choice Of Top Hats, Scale And Affordability

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Michigan Assembly Plant Wayne, Michigan

- Transformed Michigan Assembly Plant (MAP), which will produce the fuel-efficient new global Ford Focus for North American customers, features flexible manufacturing, environmentally friendly practices and a highly trained work force
- A $550 million investment transformed the plant, creating new benchmarks for flexible manufacturing. Multiple models to run down the same production line, making Michigan Assembly the world's first plant to build gasoline-powered, battery electric, hybrid electric and plug-in hybrid electric vehicles on the same line
- The plant has about 3,200 employees
- MAP also features one of Michigan's largest solar-powered generation systems and electric vehicle charging stations

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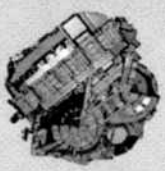


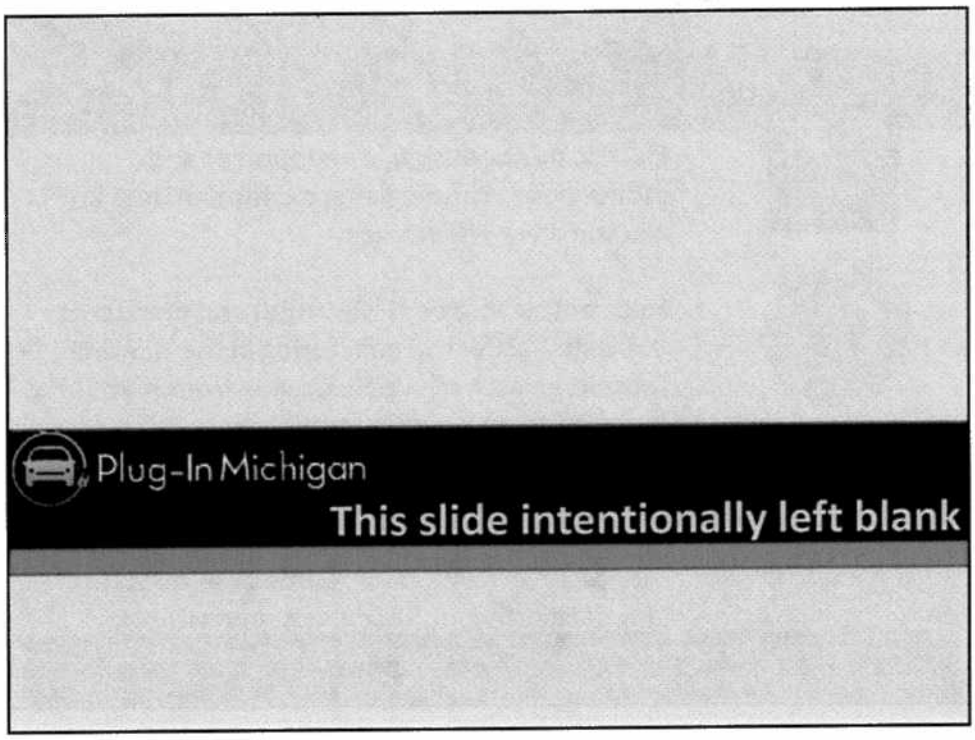
- Electric motor design, development and production technologies are critical drivers for electric drive efficiencies
- Electronic transaxle (PHEV/HEV) and Electronic Drive Unit (BEV) manufacturing in the U.S. will support growth of supply chain – from machining suppliers to commodity providers
- Battery Pack and Cell manufacturing and R&D builds upon U.S. future as the Center of Vehicle Electrification. Assembly alone does not bring long-term value of R&D and manufacturing

Sourcing decisions for key electrification components during the transition to these technologies will define where the jobs go for decades...the U.S. must compete and win

Plug-In M

Ford's Tier I Supply base in Michigan

2689 locations, $15.8 Billion in 2010


Plug-In Michigan
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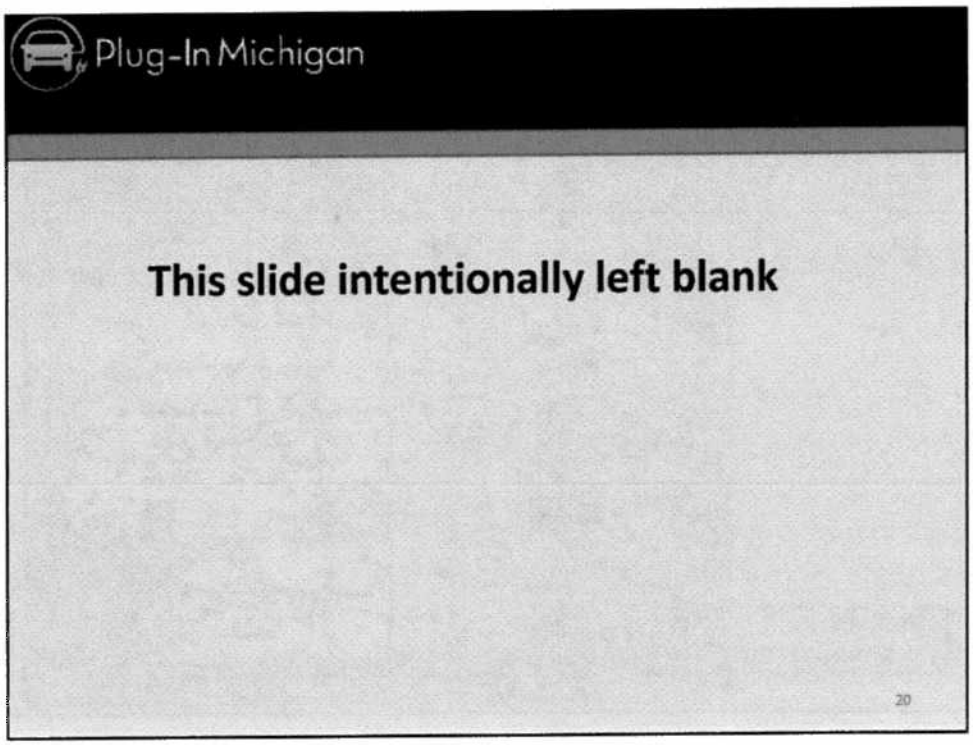
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20

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Jay Iyengar
Head of Electrified Powertrain
Chrysler Group LLC

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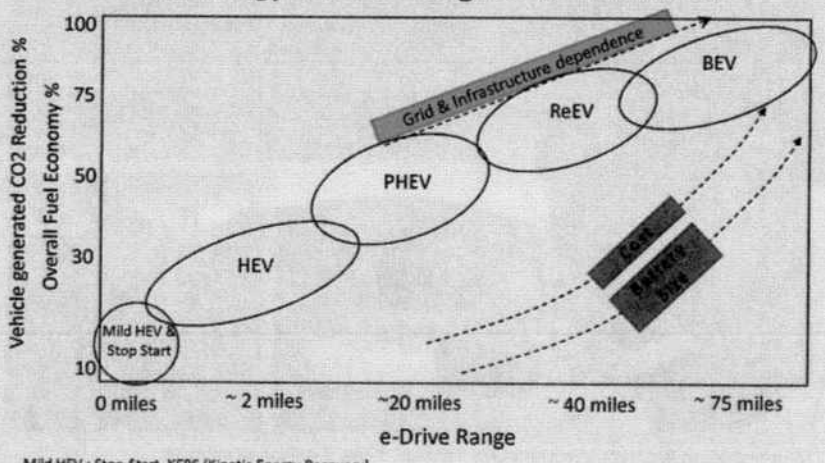
Electrification Overview

Technology Choices – Degrees of Electrification



Mild HEV : Stop-Start, KERS (Kinetic Energy Recovery)
HEV : Hybrid Electric Vehicles
ReEV : Range Extended Electric Vehicles

PHEV : Plug-in Hybrid Electric Vehicles
BEV : Battery Electric Vehicles

20

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Electrification Challenges

Challenges of Plug-in Technology

- Battery Technology – Cost, size, weight, energy density, aging, thermal management
- Grid Interface – Standardization
- Customer Acceptance - Availability of infrastructure

PHEV Ram Truck DOE Demonstration Program

- Demonstrate 140 pickup trucks in diverse geographies and climates, across a range of drive cycles and consumer usage patterns
- Smart Grid Interface and Bi-Directional Power flow capability
- Support the creation of "Green" Technology jobs and advance the state of Plug-in technology for future production integration

21

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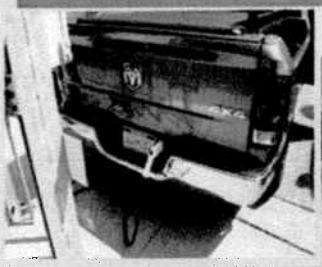
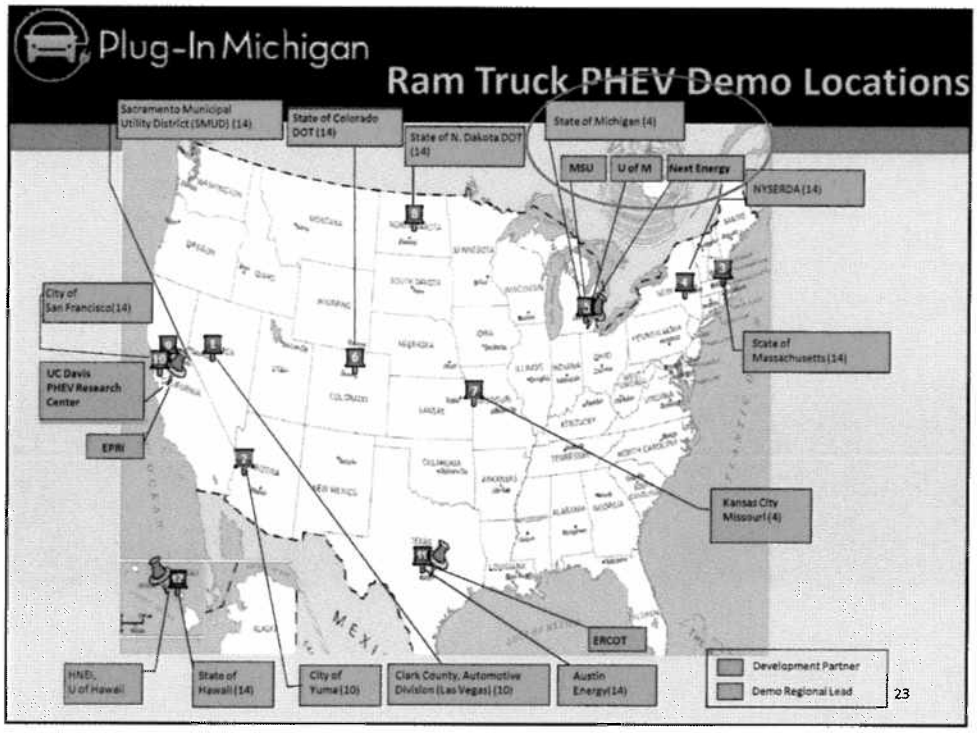
Ram Truck PHEV DOE Demo Project Summary

- V8 engine **Advanced Technology Partial Zero Emissions**
- Next Generation **Lithium Ion Battery**
- 6.6 KW charger, Charge Times : 2hrs at 220V
- Fuel Economy (City) : Charge Depleting **32MPG**
- Electric Drive Range (City) : 20 miles equivalent
- Range: **655 miles**
- Transmission : Advanced Technology Two-Mode Hybrid
- Brakes : **Regenerative Brake System**
- On-board AC power generation



- DOE Demonstration program to accumulate 6 million miles, 2 million in extreme ambients
- Partnership with Academia, Suppliers, Vehicle Fleets, and Utility Companies

22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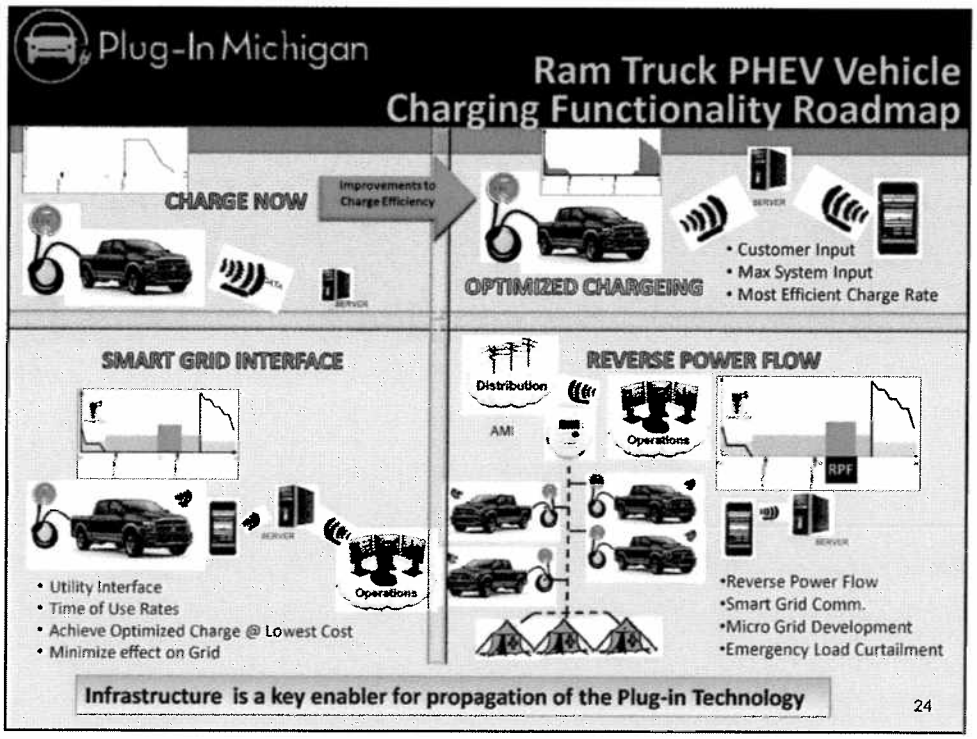
Ram Truck PHEV Demo Locations
Sacramento Municipal Utility District (SMUD) (14)
State of Colorado DOT (14)
State of N. Dakota DOT (14)
State of Michigan (4)
MSU
U of M
Next Energy
NYSERDA (14)
City of San Francisco(14)
UC Davis PHEV Research Center
EPRI
State of Massachusetts (14)
Kansas City Missouri (4)
ERCOT
HNEI, U of Hawaii
State of Hawaii (14)
City of Yuma (10)
Clark County, Automotive Division (Las Vegas) (10)
Austin Energy(14)
Development Partner
Demo Regional Lead
23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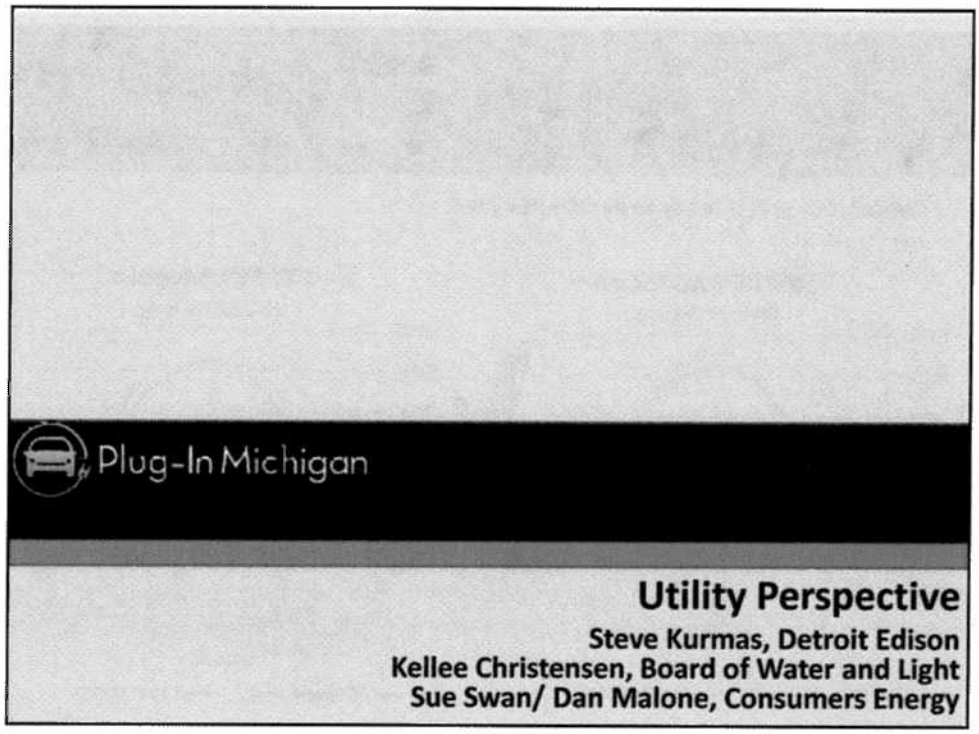
Ram Truck PHEV Vehicle Charging Functionality Roadmap
CHARGE NOW
Improvements to Charge Efficiency
OPTIMIZED CHARGEING
• Customer Input
• Max System Input
• Most Efficient Charge Rate
SMART GRID INTERFACE
• Utility Interface
• Time of Use Rates
• Achieve Optimized Charge @ Lowest Cost
• Minimize effect on Grid
REVERSE POWER FLOW
Distribution
AMI
Operations
RPF
•Reverse Power Flow
•Smart Grid Comm.
•Micro Grid Development
•Emergency Load Curtailment
Infrastructure is a key enabler for propagation of the Plug-in Technology
24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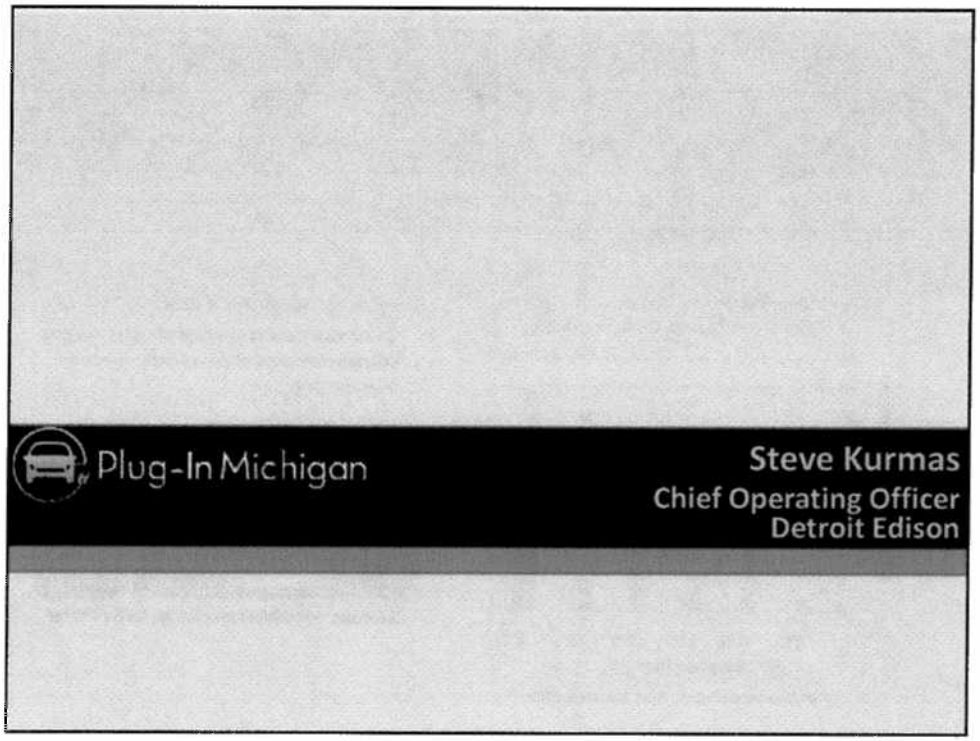
Utility Perspective
Steve Kurmas, Detroit Edison
Kellee Christensen, Board of Water and Light
Sue Swan/ Dan Malone, Consumers Energy


Plug-In Michigan
Steve Kurmas
Chief Operating Officer
Detroit Edison

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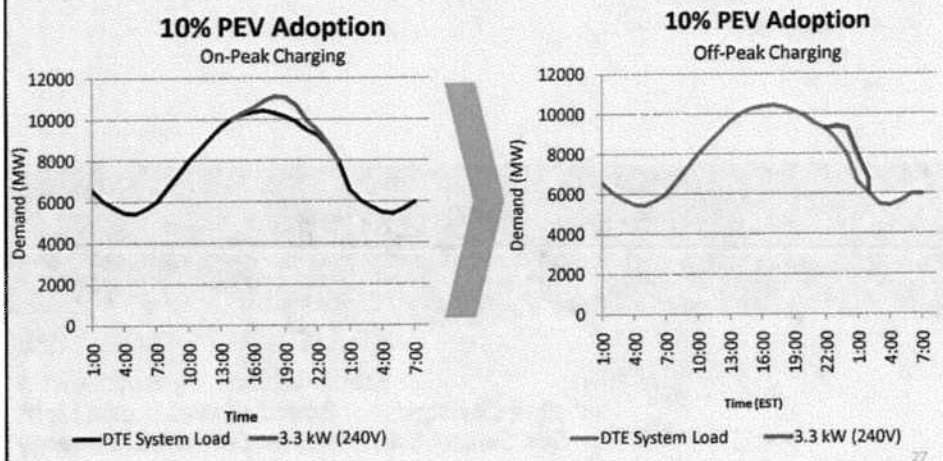
Is the Grid Ready for PEVs?

Overall, our grid is ready to handle PEV load.



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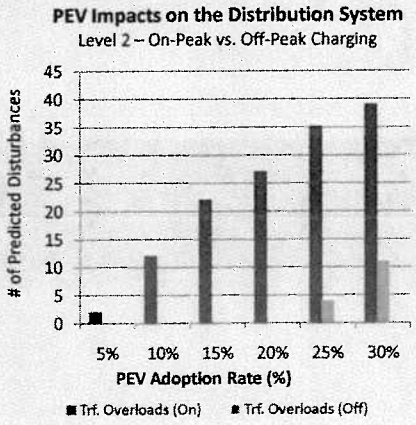
Impact of PEVs to the Distribution System

We anticipate clusters of plug-in electric vehicles, but there are ways to manage impact on the distribution system.



How can we mitigate the risk?

- Create incentives to promote off-peak charging
- Educate customers of the advantages of off-peak charging

Chevrolet Volt : Programming for Delay Charge

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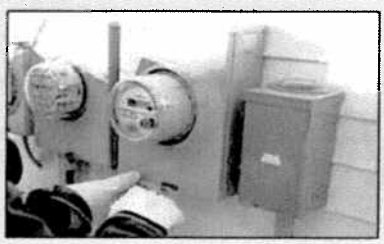
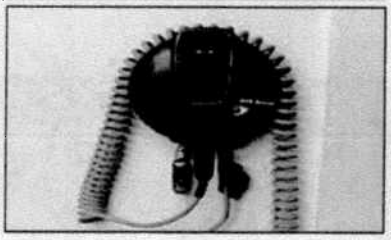
DTE Energy Electric Vehicle Program

EV Rate (D1.9)[1]		
Option 1	On-Peak	18 cents kWh
	Off-Peak	8 cents kWh
Option 2	Monthly Flat Bill: $40 Limited first 250 customers	



EVSE Incentive[2]

Customers that enroll in our EV Rate qualify for up to $2,500* which covers EVSE, installation and separate meter wiring.



[1] RD1.9 requires 240v, separate meter.
Rate Schedule: On-Peak: 9 a.m. – 11 p.m. (Mon – Fri) Off-Peak: 11 p.m. – 9 a.m. (All day weekends and Mon - Friday)
[2] Available for the first 2,500 customers that qualify, or until December 31, 2012.

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DTE Energy EVSE Installation Process

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Kellee Christensen
Manager Customer Projects, Development & Marketing
Lansing Board of Water & Light

Plug-In Michigan

Lansing Board of Water & Light

Goals

- Identify and address barriers to deployment of vehicles and infrastructure
- Assess the impact of charging vehicles on the electric distribution system
- Gain the support of the community for continued deployment and use of electric vehicles
- Bridge our community project to surrounding communities to further the goal of making Michigan plug-in ready

LANSING BWL Plug. Drive. Repeat.

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Lansing Board of Water & Light

Where We Are Now

- We have 5 Chevy Volts in our electric service territory as part of our program
- We have installed 4 charging stations and associated infrastructure
- Served on the Michigan Preparedness Taskforce to assist with addressing barriers new plug-in electric vehicle drivers may encounter

LANSING BWL Plug. Drive. Repeat.

Plug-In Michigan

Lansing Board of Water & Light

Plug-In Electric Vehicle Community Project

- The BWL Received Federal Appropriation in 2010 towards implementation of plug-in electric vehicles and supporting infrastructure
- In cooperation with surrounding communities and participating residential customer we will demonstrate the practicality and usefulness of electric vehicles for a number of purposes

LANSING BWL Plug. Drive. Repeat.

34

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Sue Swan, VP of Smart Grid
Dan Malone, SVP Dist & Cust Operations
Consumers Energy

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Consumers Energy PEV Rate Options

Rate Option 1

- Whole house time of use (TOU) rates
- Single meter
- PEV charger wired into existing panel

Rate Option 2

- TOU rates for PEV only
- Separate meter for PEV
- Standard meter and rates for all other usage

Rate Option 3

- Monthly flat rate of $35 for PEV charger usage
- Separate meter
- Standard meter and rates for all other usage

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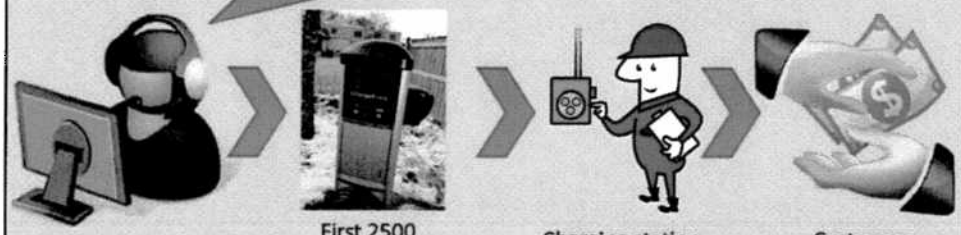
Consumers Energy Incentive Program

Consumers Energy will provide up to $2500 to cover the cost of purchase, installation and home wiring of a charging station



Incentive program specialists available

First 2500 customers eligible for reimbursement

Charging station installed by licensed electrician

Customer reimbursed up to $2500

Consumers Energy's PEV installation program Nov. 1, 2010 - Dec. 31, 2012

37

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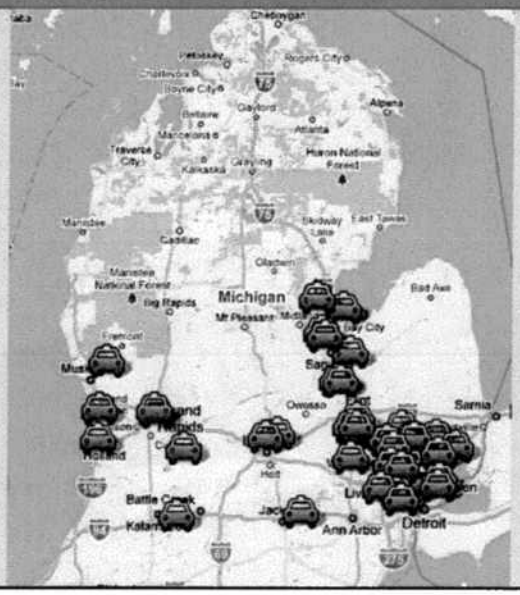
Private Charging Stations



38

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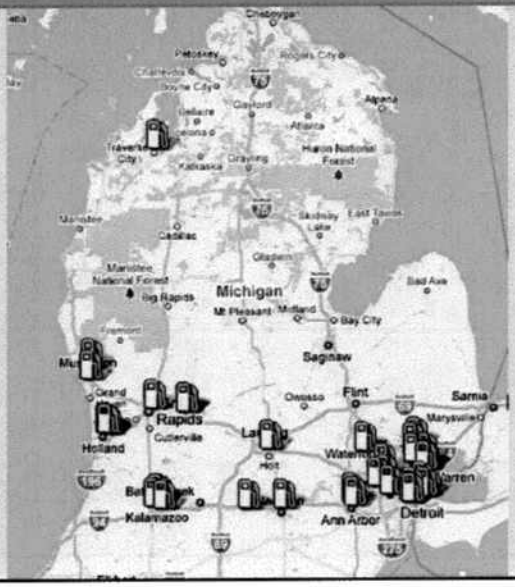
Public Charging Stations



39

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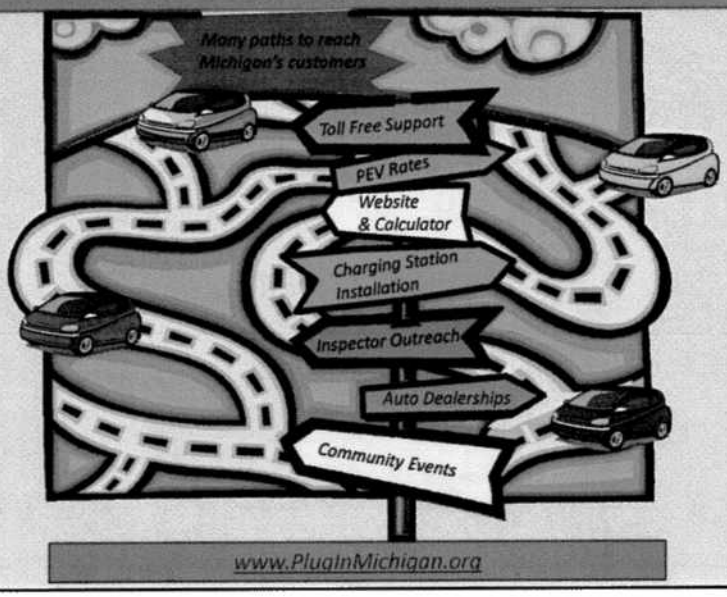
Customer Outreach & Education



40

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Michigan Economic Impact

Jim McBryde, VP Governmental Affairs
Michigan Economic Development Corporation

Plug-In Michigan

Michigan Assets: Strong Supply Chain

- Over 35 companies across 9 key supply chain segments
  - More than any other state in the US
- More than **$5.7 billion** in announced investment since November 2008
- World class Universities developing engineering curriculum to support this new industry
- A robust pipeline of companies looking to become a part of the Michigan energy storage 'eco-system'


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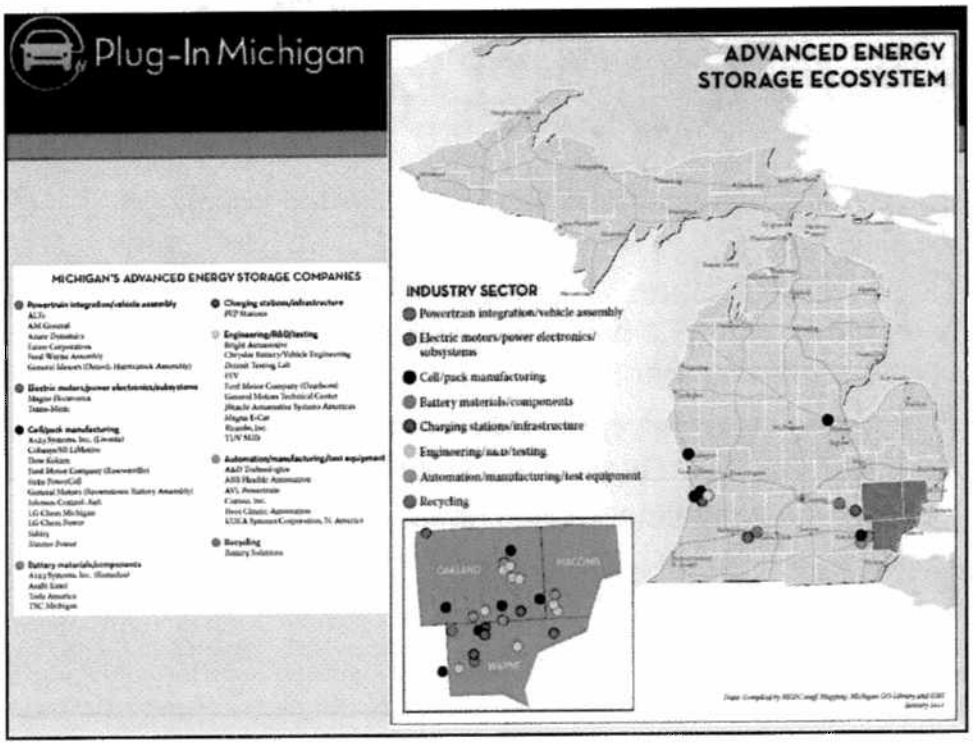
Michigan Assets: Strong Supply Chain
Materials/ Components
Cell Manufacturing
Component Suppliers
Pack Manufacturing
Engineering/ R&D/Testing
Vehicle Assembly
Automation/ Mnfg/Test Equipment
Recycling
Vehicle Integration
Announced Investment Since 11/2008
>$5.7B
43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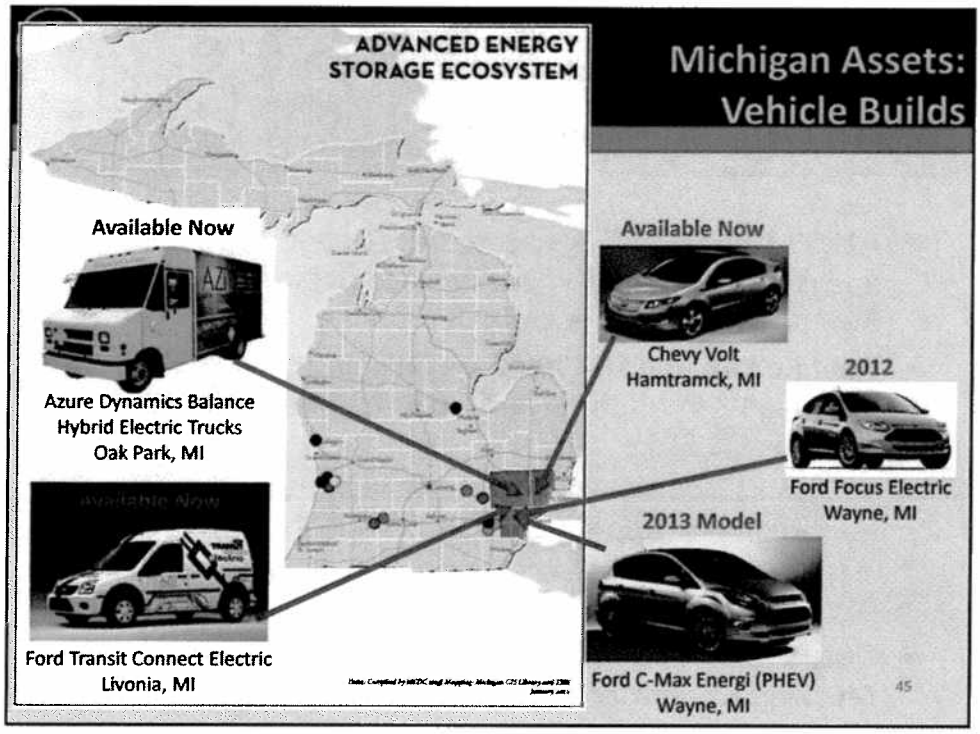
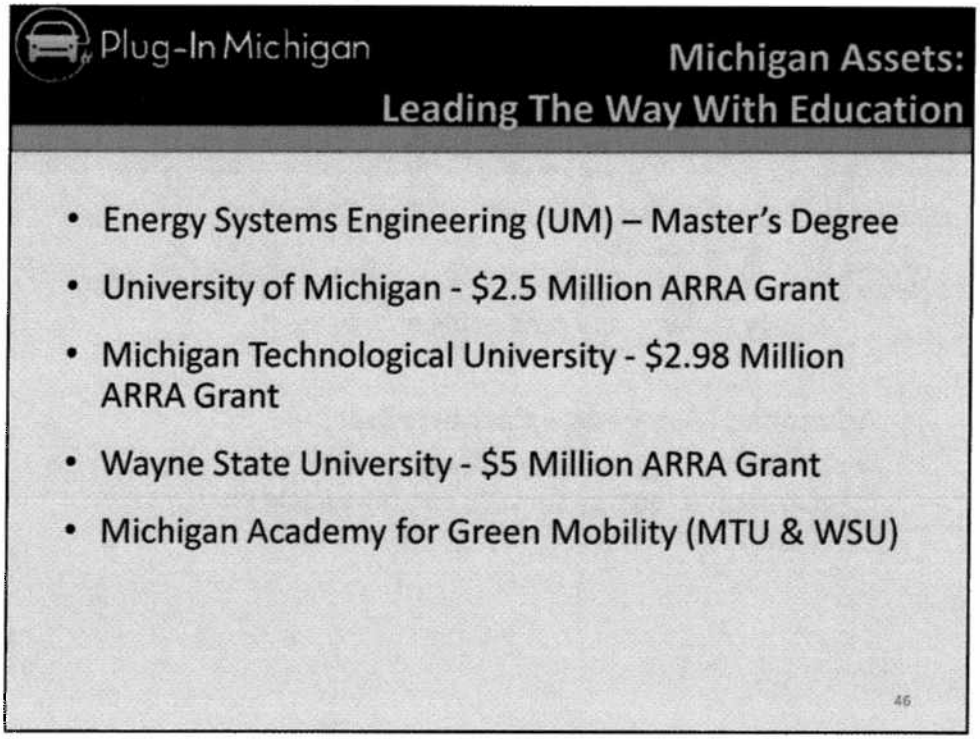
MICHIGAN'S ADVANCED ENERGY STORAGE COMPANIES
ADVANCED ENERGY STORAGE ECOSYSTEM
INDUSTRY SECTOR
Powertrain integration/vehicle assembly
Electric motors/power electronics/ subsystems
Cell/pack manufacturing
Battery materials/components
Charging stations/infrastructure
Engineering/ R&D/testing
Automation/manufacturing/test equipment
Recycling
OAKLAND
MACOMB
WAYNE


ADVANCED ENERGY STORAGE ECOSYSTEM
Michigan Assets: Vehicle Builds
Available Now
Azure Dynamics Balance Hybrid Electric Trucks Oak Park, MI
Ford Transit Connect Electric Livonia, MI
Available Now
Chevy Volt Hamtramck, MI
2012
Ford Focus Electric Wayne, MI
2013 Model
Ford C-Max Energi (PHEV) Wayne, MI
45


Plug-In Michigan
Michigan Assets: Leading The Way With Education
• Energy Systems Engineering (UM) – Master's Degree
• University of Michigan - $2.5 Million ARRA Grant
• Michigan Technological University - $2.98 Million ARRA Grant
• Wayne State University - $5 Million ARRA Grant
• Michigan Academy for Green Mobility (MTU & WSU)
46

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Michigan Assets: Battery Manufacturers Update

- **A123's Livonia** facility was commissioned Sept. 2010 and is running to full capacity; second facility in **Romulus** has commenced operations
- **Dow Kokam** and **LG Chem** are finishing construction on their plants in **Midland** and **Holland**; product to start shipping Q1 2012
- **Johnson Controls-Saft's Holland** facility is supplying battery packs to **Azure Dynamics (Oak Park)** for **Ford's** Transit Connect Electric assembled by **AM General (Livonia)**
- **fortu Power Cell** will commence groundbreaking in **Muskegon** Summer 2011

47

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Future Focus: Complementary Markets

- **Power Electronics**
  - An industry that can leverage Michigan's automotive, energy storage, and renewable energy assets
- **Advanced Materials – Carbon Fiber**
  - A materials opportunity to leverage Michigan's automotive, energy storage, and renewable energy assets

48

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Thank you!

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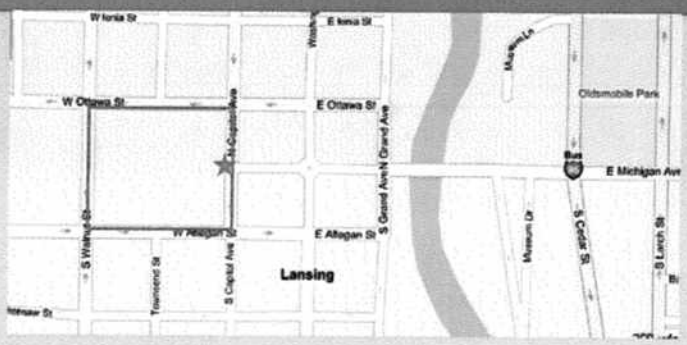
Ride and Drive Route



The route is:

Begin at Michigan Ave, in front of Capital Building (star) There is a check in table to verify Drivers Licenses, sign waivers and receive tickets. A single lane around the Capitol is blocked off for this event.
Proceed South on N Capitol Ave two blocks to W Allegan St. (against traffic) Turn right.
Proceed West on W Allegan St. two blocks to S Walnut St. Turn right.
Proceed North on S Walnut St one block to W Ottawa St. (against traffic) Turn right.
Proceed East on W Ottawa St two blocks to N Capitol Ave. Turn right.
Proceed South on Capitol to starting point.